



*CoolSNAP™*  
**KINO**

USER MANUAL



High Performance EMCCD & CCD Cameras for Life Sciences

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## Your Responsibility


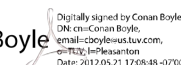






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<i>Client:</i>		Photometrics 3440 East Britannia Drive Tucson, AZ 85706		Terry Puhala (520) 547-2718 (520) 573-1944 tpuhala@photometrics.com	
<i>Identification:</i>	Scientific Digital Camera		<i>Serial No.:</i>	A12A846002	
<i>Test Item:</i>	CoolSNAP MYO		<i>Dates Tested:</i>	May 14 – 16, 2012	
<i>Testing Locations:</i>	TUV Rheinland of North America 2305 Mission College Blvd., Suite 105 Santa Clara, CA 95054 U.S.A.		TUV Rheinland of North America 1279 Quarry Lane, Suite A Pleasanton, CA 94566 U.S.A.		
<i>Test Specification:</i>	Emissions: EN 61326-1:2006, EN 55011:2009+A1:2010, FCC Part 15 Subpart B:2011, EN 61000-3-2:2006/A2:2009, EN 61000-3-3:2008 Immunity: EN 61326-1:2006, , EN61326-2-6: 2005 EN 61000-4-2:2009, EN 61000-4-3:2006/A2:2010, EN 61000-4-4:2004+A1:2010, EN 61000-4-5:2006, EN 61000-4-6:2007, EN 61000-4-8:2010, EN 61000-4-11:2004				
<i>Test Result:</i>	<b>The above product was found to be Compliant to the above test standard(s).</b>				
<i>I tested by:</i> Jeremy Luong			<i>I reviewed by:</i> Conan Boyle		
<div style="text-align: center;">   May 17, 2012  Date _____ Name _____ Signature _____ </div>			<div style="text-align: center;">   May 18, 2012  Date _____ Name _____ Signature _____ </div>		
<i>Other Aspects:</i>	<b>None</b>				
Abbreviations: OK, Pass, Compliant, Complics = passed Fail, Not Compliant, Does Not Comply = failed N/A = not applicable					
<b>PLEASANTON</b>					
 US5254		 NVLAP LAB CODE 500011-0		<b>INDUSTRY CANADA</b> 2932M-1	
				 1097	
<b>SANTA CLARA</b>					
 US5251		 NVLAP LAB CODE 100011-0		<b>INDUSTRY CANADA</b> 2932D-1	
				 1097	

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## Description

The Photometrics® CoolSNAP KINO is an ideal camera for medium to low-light scientific and industrial microscopy. This camera incorporates a progressive-scan CCD (charge-coupled device), a 14-bit digitizer, and low-noise electronics to produce monochrome images at greater than 2.8 megapixel resolution.

## System Components

In addition to the components shown below, your CoolSNAP™KINO package also includes a PVCAM® CD-ROM, a power supply, a *Quick Install Guide*, and a USB cable.



**Camera**



**USB 2.0 Interface**

## About This Manual

This *CoolSNAP KINO User Manual* is divided into five chapters. It is suggested that you read the entire manual before operating the camera in order to ensure proper use. The chapters that follow this introduction are

- **System Installation** — Instructions for connecting your CoolSNAP KINO camera to your computer via the CoolSNAP KINO integrated USB 2.0 interface.
- **Operating Features** — Discusses CoolSNAP KINO features such as antiblooming and trigger modes.
- **Troubleshooting** — Provides answers to camera system problems.
- **Basic Specifications** — Provides specifications for CoolSNAP KINO system components.

## Precautions

The CCD and other system electronics are extremely sensitive to electrostatic discharge (ESD). To avoid permanently damaging the system, please observe the following precautions:

- If you are using high-voltage equipment (such as an arc lamp) with your camera system, be sure to turn the camera power *on last* and power the camera *off first*.
- Never connect or disconnect any cable while the camera system is powered on.
- Although you should switch off the *camera's* power supply before disconnecting any camera system cable, you do *not* need to power off your computer to detach the cables.
- Use caution when triggering high-current switching devices (such as an arc lamp) near your system. The CCD can be permanently damaged by transient voltage spikes. If electrically noisy devices are present, an isolated, conditioned power line or dedicated isolation transformer is highly recommended.
- Always leave at least 1 inch of space around the camera housing.
- Never open the camera. There are no user-serviceable parts inside the CoolSNAP KINO camera. Opening the camera voids the warranty.
- Use only the integrated USB 2.0 interface, cables, and power supply designated for this camera system. Using non-CoolSNAP KINO cables, PCI cards, or power supplies may result in permanent damage to your system.
- Do not use a C-mount lens that has optics that extend behind the flange of the lens.

## Environmental Requirements

The CoolSNAP KINO camera system should be operated in a clean, dry environment.

The camera system's ambient operating temperature is 0°C to 30°C with 80% relative humidity, noncondensing.

## Storage Requirements

Store the CoolSNAP KINO camera system in its original containers. To protect the system from excessive heat, cold, and moisture, store at an ambient temperature between -20°C and 60°C with a relative humidity of 0% to 90%, noncondensing.

## Microscopes, Lenses, and Tripods

The camera has a standard threaded video mount and can be mounted to any microscope that accepts a standard C-mount adapter. The camera also allows you to install any lens that is compatible with a standard threaded video mount as long as its optics do not extend behind the flange of the lens.

The CoolSNAP KINO camera can be mounted to a tripod using the tripod mounting attachment located on the bottom of the camera. See *Additional Measurements* for more information.

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**Note:** In microscopy applications, a 1.0x C-mount camera coupler is recommended for proper field of view.

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## Repairs

The CoolSNAP KINO camera system contains no user-serviceable parts. Repairs must be done by Photometrics. Should your camera system need repair, contact Photometrics Customer Service. Please save the original packing materials so you can safely ship the camera system to another location or return it for repairs if necessary.

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**Note:** Do not open the camera. Opening the CoolSNAP KINO camera voids the warranty.

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## Cleaning

Clean exterior surfaces of the camera with a dry, lint-free cloth. To remove stains, contact Photometrics Customer Service. To clean the camera's imaging window, use only a filtered compressed-air source. Handheld cans are not recommended, as they may spray propellant onto the window. Do not touch the window.

## **Photometrics Customer Service**

If you have any questions about your camera system, contact Photometrics Customer Service. When you call, please have your Photometrics job number or equipment serial numbers available.

### **United States and Canada:**

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Sakurai Bldg. 2-8-19, Fukugawa

Koto-ku 135-0033, Japan

Tel: 81.3.5639.2731

### **Europe:**

Roper Engineering s.r.o.

Technologicka 372/2

70800 Ostrava , Czech Republic

Tel: 420.597.305.857

General product information and answers to some customer service questions can be found on our website: <http://www.photometrics.com>

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Carefully review the *Precautions* section on page 2 before performing any of the procedures outlined here. Use only CoolSNAP KINO cables with your CoolSNAP KINO camera. Using different cables may result in permanent damage to your system.

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## Introduction

Your CoolSNAP KINO camera system has the following hardware components:

- USB 2.0 cable
- Camera
- Power supply with power cable and power cord

All of these hardware components should be included with your shipment.

Keep all the original packing materials so you can safely ship the CoolSNAP KINO system to another location or return it for service if necessary.

If you have any difficulty with any step of the instructions, call Photometrics Customer Service.

## Software Compatibility Requirements

The CoolSNAP KINO package includes the PVCAM driver, which is fully compatible with your CoolSNAP KINO camera.

All imaging software must be PVCAM-compatible. For full access to imaging software functions, PVCAM must be version 2.9.3 or higher.

## Host Computer Requirements

The host computer for your CoolSNAP KINO camera must have the following:

- Windows® 7 Professional operating system
- Intel® Core™ i5 processor
- 4 GB of RAM (or greater)
- CD-ROM drive or Internet access to install the driver
- At least one USB interface port

## Multiple Cameras

PVCAM supports multiple open cameras. In order to use this function, it must also be supported by your imaging software.

## Software Installation

An Installation Guide appropriate to your system is included in the box. This guide provides step-by-step instructions for installing the camera interface software.

The CD-ROM contains the following files.

- **Readme text files** — these files contain the latest information on the software installations and should be read before you run the PVCAMSetup program.
- **PVCAMSetup software program** — this software installs the camera interface software.
- **Acrobat directory** — this directory contains subdirectories containing installation programs for Acrobat® Reader®.
- **Manuals directory** — this directory contains user manuals in PDF format.

## Installing the PCI/USB 2.0 Card

You will have the option to use a USB 2.0 interface to allow the camera to communicate with your computer. Onboard ports are preferred. Most likely, you will not require an external USB 2.0 card.

If you run into issues using an onboard port, however, then you will need to utilize an external card. You will need to order a PCI-E USB interface card from Photometrics.

After plugging in your camera to the USB 2.0 spot, go to *Connecting Your CoolSNAP KINO Camera*.



## Connecting Your CoolSNAP KINO Camera

The DATA cable connects your CoolSNAP KINO camera to the USB 2.0 interface. It is designed to serve as a conduit for data.



### To connect your CoolSNAP KINO camera:

1. Connect the standard USB end of the DATA cable to the USB 2.0 interface on your computer.
2. Connect the other end of the DATA cable to the DATA connector located on the back of the camera (shown below, near bottom of blue ellipse).
3. Connect the CoolSNAP KINO power supply's POWER cable to the POWER connector located on the back of the camera (shown below, near top of blue ellipse).



The following connectors are located on the back of the CoolSNAP KINO camera:

- **USB DATA port**
- **DC POWER port**
- **I/O port:** HR212-10P-10PC connector for input/output control signals

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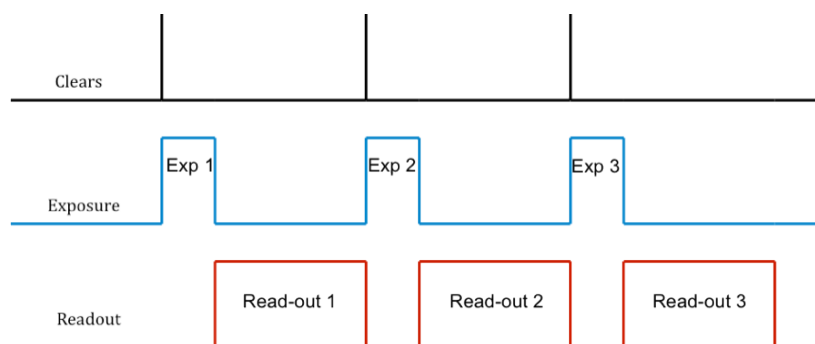
## Dual-Mode Operation

### Normal mode

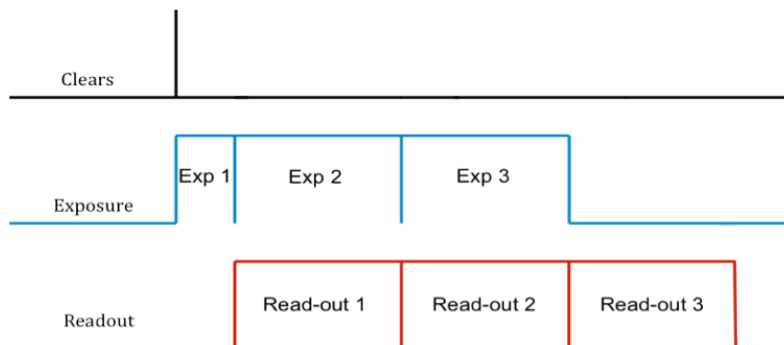
A unique feature of CoolSNAP KINO is that it has two different CCD clocking modes, one of which allows you to remove the glow that can appear in an image's corners (arising from the preamplifier). In the PVCAM implementation, the clocking modes are referred to as "Normal" and "Alternate Normal".

In "Normal" mode, the CCD is optimized for maximum antiblooming protection and frame rate.

When the camera *does not* expose and read out images simultaneously, it is in Non-Overlap mode. Non-Overlap mode is set by choosing "Pre-Exposure Clearing" for the clearing mode of the camera. This allows a clear before each exposure. The following waveforms show how Non-Overlap mode functions. The main benefit of Non-Overlap mode is that there are no limitations imposed upon the exposure time, and the set exposure time is the actual exposure time. The tradeoff for this accuracy is the frame rate, as you have to wait for each frame to be completely read out before beginning the next exposure.



When the camera is able to expose and read out images simultaneously, it is in Overlap mode. Overlap mode is set by choosing "Pre-Sequence Clearing" for the clearing mode of the camera. This allows one clear before the imaging sequence starts. The following waveforms show how Overlap mode functions. When using Overlap mode, the frame rate is higher as compared to Non-Overlap mode and provides the ability to continuously image. However, since you are able to expose and read out simultaneously, the minimum exposure time is dependent on the time taken to complete readout. As such, excluding the first frame, any exposure time smaller than the readout time defaults to an exposure duration equal to the readout time.



**Alternate Normal mode**

In this mode, the preamplifier is switched off during the exposure to eliminate the background generated by preamplifier glow. It may be best to always operate the camera in Alternate Normal mode (either in Non-Overlap or Overlap mode).

**Antiblooming**

Typically, interline CCD devices are designed with antiblooming capabilities. To prevent excess electronic charge from migrating to adjacent pixels, "drains" are built into the CCD. These drains remove any excessive charge generated from an overexposed pixel. The interline CCD utilized by CoolSNAP KINO will prevent blooming for optical signals greater than 1000 times the full-well capacity of a single pixel.

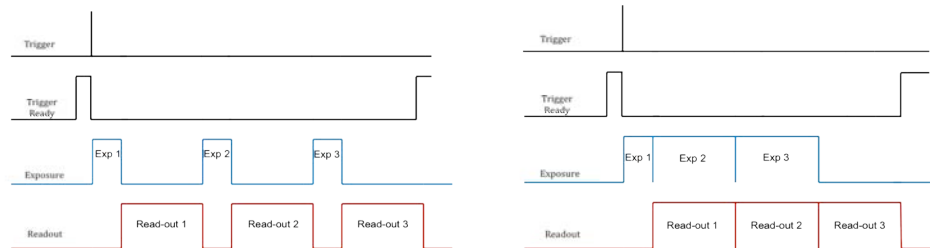
**Triggered Operation**

CoolSNAP KINO offers several methods of integration with external trigger sources, such as delay generators or laser pre-triggers. Each camera has an HR212-10P-10PC I/O connector (pinout functions are described on page 20) on the back for trigger-in/out and various TTL input and output operations.

A special cable is available to access primary signals such as "Trigger-in," "Expose out," "End of frame," and "Interline shift." In the default mode, the camera triggers on the rising edge of a TTL signal. CoolSNAP KINO cameras support the trigger modes described on the following page.

## Trigger-first mode

In this mode, the camera requires one trigger to begin the acquisition of a stream of images. Once the trigger is received, the camera runs using its internal timed mode, independent of any future triggers. It is possible to run this triggering mode in either Non-Overlap mode (left figure) or Overlap mode (right figure).



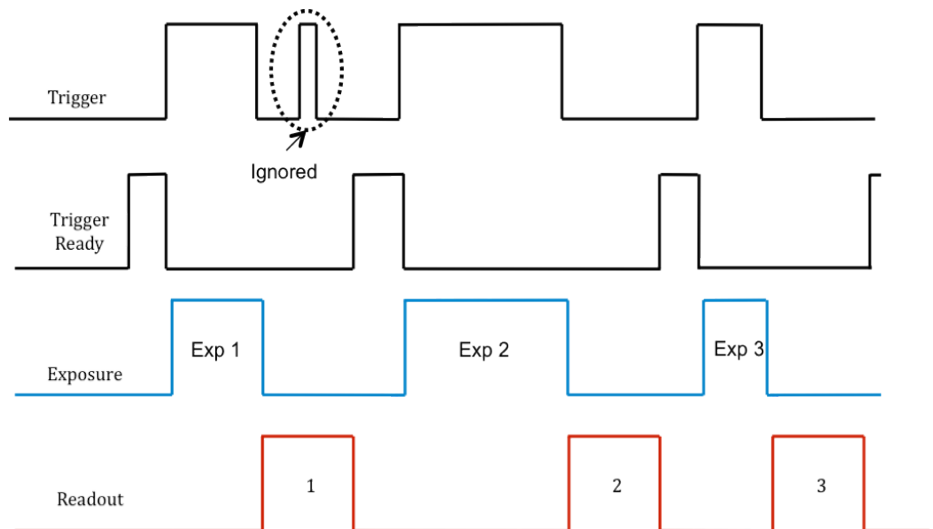
## Strobe mode

In this mode, each frame in the sequence requires a trigger. When a trigger is received, the camera exposes for the set in the software. If Strobe mode is set to run in Overlap mode then all exposures except the initial one will be equal to, or larger than, the readout time. Triggers received while Trigger Ready is low are ignored. For a sequence of one frame, Strobe mode and Trigger-first mode are the same. Non-Overlap mode is shown on the left; Overlap mode is shown on the right.



## Bulb mode

In this mode, each frame in the sequence requires a trigger. The camera exposes for the duration the trigger signal is high. Exposure time entered into the software is not used in this mode. Non-Overlap mode is shown below.



## CoolSNAP KINO

### Application Examples

**Example 1** *"I have a CoolSNAP KINO and want to operate the camera in the most sensitive setting for taking high-resolution, single images."*

For this application, the readout speed of the camera should be set to 10 MHz to reduce the read noise while offering moderate frame rates. Furthermore, the camera gain state should be set to 3. These settings will operate the camera in its most sensitive mode.

**Example 2** *"I would like to acquire sequences of images with a CoolSNAP KINO to study time-correlated phenomena. My light level is fairly high and I want to optimize the acquisition rate of the camera."*

First, the camera speed should be set to 20 MHz. In addition, the "clearing" mode of the camera should be set to "Clear Pre-Sequence" to remove the clearing overhead between frames. Moreover, camera gain state 1 should be used to maximize dynamic range to view bright and dim objects in the same image. Finally, reducing the region of interest and increasing binning will increase the frame rate further.

**Example 3** *"I would like to use a CoolSNAP KINO to study the immediate response of a specimen to an electrical stimulus."*

The camera should be set up as in Example 2 for optimum time resolution. Furthermore, the camera should be set to "Trigger-first" mode. The same TTL signal that is providing the electrical stimulus should be sent to pin number 1 (Trigger In) on the I/O port on the back of the camera.

**Example 4** *"I want to use my CoolSNAP KINO to observe an experiment that is sensitive to vibration (e.g., AFM) or moving electric fields (e.g., electrophysiology)."*

CoolSNAP KINO has no fan and thus offers a completely vibration-free operation due to employing passive cooling.

*If you have any difficulty while troubleshooting, or do not see your camera system's symptoms listed here, contact Photometrics Customer Service.*

## **New Hardware Found Dialog Box Does Not Appear**

If the New Hardware Found dialog box does not appear after plugging in the camera, contact Photometrics Customer Service.

## **Images Not Displayed**

If no images appear:

- Confirm that the switch on the camera is set to "on".
- Confirm that the correct CoolSNAP KINO camera is selected in your imaging software application.
- Power off the camera and the host computer and check all system connections (particularly the DATA and POWER cables). Restart.
- Confirm that the camera is operational by taking an image with a standard C-mount lens attached to your CoolSNAP KINO. Using normal room lighting, place the camera on a table about 3 meters away from an object and acquire an image.

If the problem persists, contact Photometrics Customer Service.

### **Bright Spots in Image / Increased Background Noise**

If you notice bright spots (hot pixels) in the image or an increase in background noise, take another calibration image and then re-acquire the original image.

### **Camera Running Too Warm**

It is normal for the camera to be slightly warm to the touch while in operation. However, if the camera is more than slightly warm to the touch (and at least 1 inch of space has been left around the camera housing), switch off the camera immediately and contact Photometrics Customer Service.

### **PVCAM Error Message Appears**

If a PVCAM error message appears, note the message's number code and contact Photometrics Customer Service.

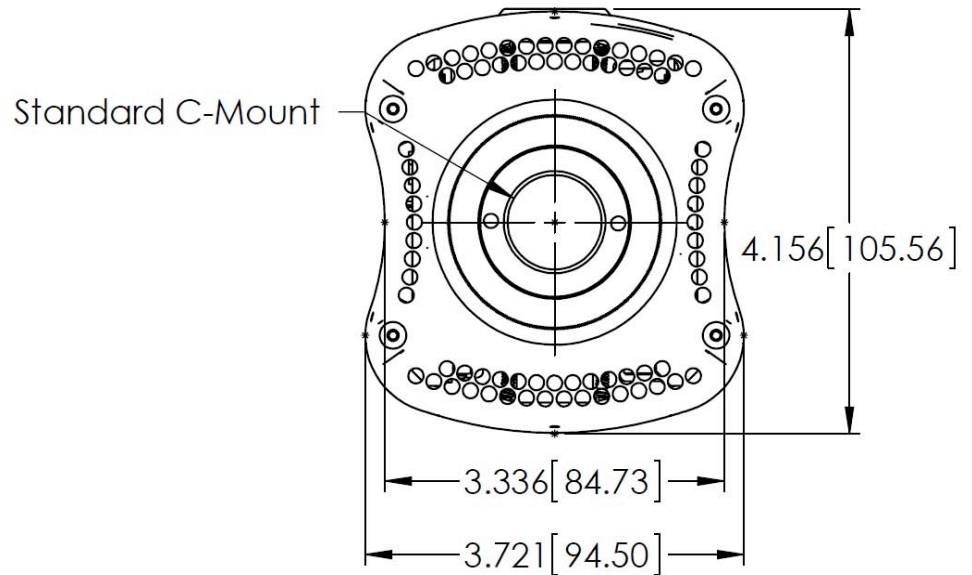
### **Lengthy Pauses During Imaging**

If you notice lengthy pauses marked by a lot of disk activity while imaging:

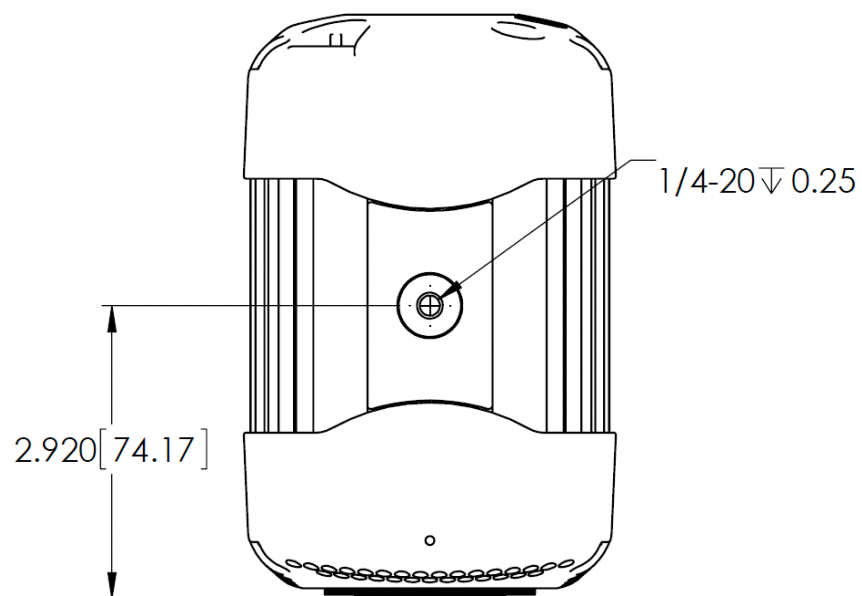
- Close any other programs that may be running.
- Install more physical memory to your computer system.



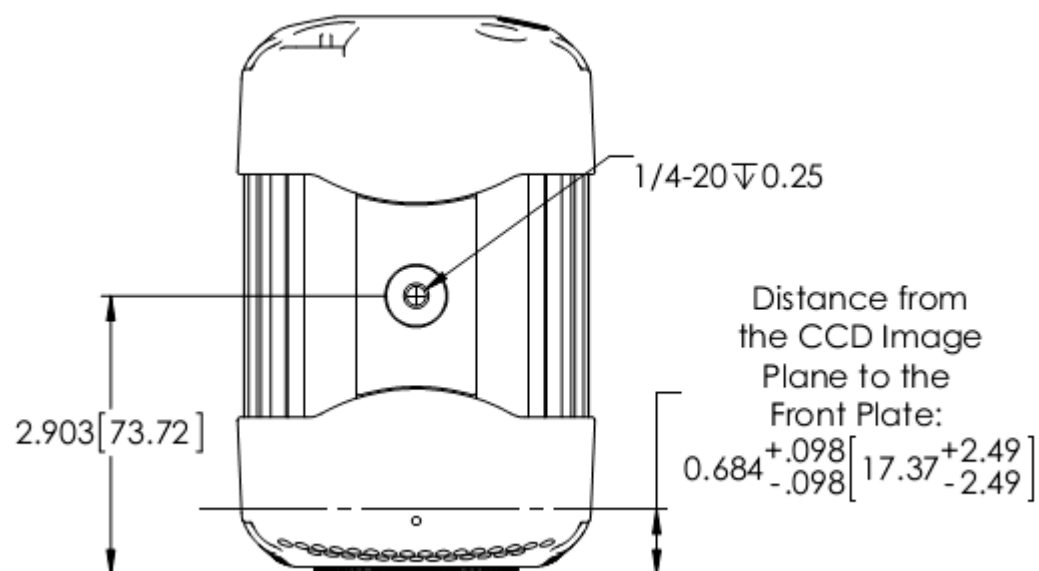
## Camera Dimensions (Front)



**Camera  
Dimensions  
(Bottom)**



## Focal Plane Measurement



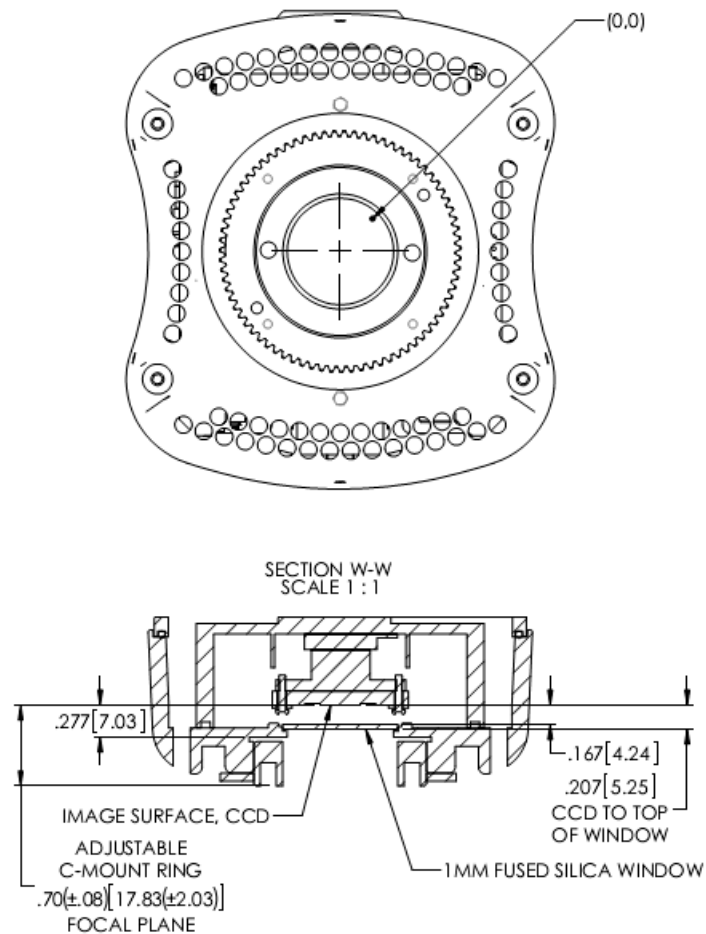
## Additional Measurements

<i>Camera weight</i>	2.3 lb. (1.1 kg)
<i>Tripod mounting hole (bottom of camera)</i>	.25 in.-20 UNC-2B

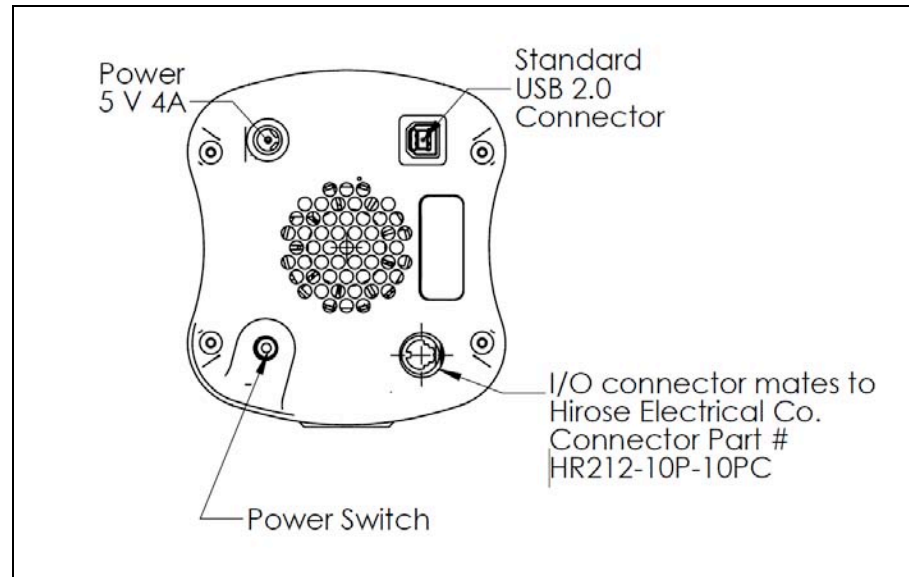
## CCD Specifications and Orientation

<i>Image Type</i>	Mono
<i>Resolution</i>	1940 x 1460
<i>Pixel Size</i>	4.54 $\mu\text{m}$ x 4.54 $\mu\text{m}$
<i>Digitization Rates</i>	20 MHz, 10 MHz, 1.25 MHz

### CCD Orientation



## Connectors



The following connectors are located on the back of the camera.

- ***I/O port:*** HR212-10P-10PC connector for input/output control signals
- ***USB DATA port***
- ***DC POWER port***
- 



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**Note:** External power supply *must not* exceed +5 Vdc, 4 A.

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## I/O Connector Pinout

The I/O (Input/Output Status) connector provides information about trigger function, DAC, and TTL signals. Inputs must be at least 3.15 V for a high and less than 0.9 V for a low.

The numbers on the I/O connector diagram correspond to the numbers given to the definition of each of the pins.

**Trigger port connects to Hirose connector HR212-10P-10PC...**

Pin #	Signal
1	Trigger In
2	Expose Out
3	Read Out
4	Shutter Out
5	Input – PVCAM Programmable
6	Trigger Ready Out
7	Output – PVCAM Programmable
8	Output – PVCAM Programmable
9	Power Ready
10	Ground

Triggering signal behavior:

- **Trigger In** – the input trigger to the camera
- **Camera Expose** – represents when the camera is exposing/acquiring an image
- **Read Out** – represents the readout of the image
- **Shutter Output** – TTL output to control timing of an external shutter driver
- **Trigger Ready** – Represents when the camera is ready to receive a trigger
- **Power Ready** – Reflects power status for the camera (+5 V = on, 0 V = off)
- **Ground** – system digital ground

The types of triggering supported by CoolSNAP KINO are as follows:

- **Trigger-first mode** (Overlap/Non-Overlap)
- **Strobe mode** (Overlap/Non-Overlap)
- **Bulb Mode** (Non-Overlap)

There are five shutter behavior modes that are available:

- **Open Never** – Shutter is always closed.
- **Open Pre-Exposure** – Open before every exposure, closed when not exposing.
- **Open Pre-Sequence** – Open before start of sequence, closed at end of sequence.
- **Open Pre-Trigger** – Causes shutter to open before external trigger is received. In non-triggered mode, operates as “Open Pre-Exposure”.
- **Open No Change** – Sends no signals to open or close the shutter.

## Power Supply Specifications

*Voltage Output:* +5 Vdc, 4 A

*Voltage Input:* 100 – 240 V @ 50 – 60 Hz





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